

Supplementary Materials

Supplementary Method

Questionnaire

Screening

- What is your gender? Response: Male/Female.
- What is your age? Response: Free text number (years).
- Which prefecture do you currently live in? Response: Free text.
- Are you currently pregnant? Response: Yes/No.
- Have you had any of the following diagnoses or surgeries from your doctor? If not, answer “None.” Response: 1. Hypertension; 2. Diabetes mellitus; 3. Hyperlipidemia; 4. Gastric and small intestinal inflammation, such as gastric ulcer and duodenal ulcer; 5. Inflammatory bowel disease/ulcerative colitis/Crohn’s disease; 6. Hemorrhoidal disease; 7. Diverticulitis/diverticulosis; 8. Cancer of the gastrointestinal tract; 9. Other cancers; 10. Cerebrovascular disease/neurological disease, such as cerebral infarction; 11. Chronic obstructive pulmonary disease; 12. Liver disease; 13. Kidney disease; 14. Other diseases; 15. Abdominal surgery other than appendicitis.

Main Survey

- What is your current occupation? Response: 1. Company staff/civil servant; 2. Self-employed/freelancer; 3. Part-time; 4. Homemaker; 5. Retired/unemployed; 6. Student; 7. Other.
- What is your net annual household income? Response: 1. < 3 million yen; 2. 3-< 4 million yen; 3. 4-< 6 million yen; 4. 6-< 8 million yen; 5. 8-< 10 million yen; 6. 10-< 15 million yen; 7. 15-< 20 million yen; 8. 20-25 million yen; 9. > 25 million yen; 10. I don’t want to answer/I don’t know.
- What is your highest academic qualification? Response: 1. Graduated from junior high school; 2. Graduated from senior high school; 3. Graduated from a specialized school; 4. Graduated from technical college; 5. Graduated from junior college; 6. Graduated from university (four-year system); 7. Post-graduate qualification; 8. Other.
- What are your height and weight? Response: Free text number (height cm, weight kg).
- Do you often think you are constipated? Response: Often/sometimes/neither/rarely/never.
- Are you taking medicines related to the stomach or esophagus (such as drugs that suppress stomach acid)? Response (multiple items can be selected): 1. Proton pump inhibitors; 2. Potassium ion-competitive acid blockers; 3. Histamine H2 receptor blockers; 4. Gastrointestinal motility activators; 5. Chinese herbs; 6. Other drugs related to stomach and esophagus; 7. Yes but I don’t remember the name; 8. No, I don’t take drugs related to stomach and esophagus.
- Please answer Yes or No to each of the following items: I am taking medicine to reduce blood pressure; I am taking insulin injections or drugs to reduce blood glucose; I am taking medicine to lower cholesterol; I have previously had a stroke (cerebral hemorrhage, cerebral infarction or neurological disease) or received treatment by a doctor; I am receiving treatment for depression or anxiety by a doctor; I have been diagnosed with anemia by a doctor.
- Please answer Yes or No to each of the following items: I am taking oral medication for Parkinson’s disease; I am taking oral medication for epilepsy; I am taking oral antidepressants; I am taking oral medication for anxiety disorders and hypnotics; I am taking oral iron and iron supplements.
- Are you satisfied with your current bowel movements? Response: Very satisfied/somewhat satisfied/neither/somewhat dissatisfied/very dissatisfied.
- Are you currently taking constipation medication or laxatives or using enemas? Response: Yes/No.
- If you answered yes, select all the drugs you are currently taking or using. Response (multiple items can be selected): 1. Irritant laxatives; 2. Enemas/suppositories; 3. Magnesium saline laxatives; 4. Osmotic laxatives; 5. Inflatable laxatives; 6. Chloride channel activators, guanylate Cyclase C agonists or ileal bile acid transporter inhibitors; 7. Polyethylene glycols; 8. Other constipation drugs and laxatives with specific names; 9. Oral medication but I don’t remember the name.
- Are you satisfied with your current constipation medication? Response: Very satisfied/somewhat satisfied/neither/somewhat dissatisfied/very dissatisfied.
- How do you obtain constipation medication and laxatives? Response (multiple items can be selected): 1. Purchased in pharmacies; 2. Prescribed by physicians; 3. Purchased via internet; 4. Other methods.
- Please answer whether you would / would not pay the following amounts per month (including tax) for a constipation drug: 1. \geq 5000 yen; 2. 3000-4999 yen; 3. 1000-2999 yen; 4. Not more than 999 yen.

Other questions included in the survey were related to Rome IV criteria,¹ the Gastroesophageal Reflux Disease Questionnaire,² the Gastrointestinal Symptom Rating Scale,³ the 8-item Short Form Health Survey Questionnaire,⁴ the Constipation Scoring System,⁵ and the Frequency Scale for the Symptoms of gastroesophageal reflux disease,⁶ for a total of 39 items.

References

1. Lacy BE, Mearin F, Chang L, et al. Bowel disorders. *Gastroenterol* 2016;150:1393-1407.
2. Jones R, Junghard O, Dent J, et al. Development of the GerdQ, a tool for the diagnosis and management of gastro-oesophageal reflux disease in primary care. *Aliment Pharmacol Ther* 2009;30:1030-1038.
3. Svedlund J, Sjödin I, Dotevall G. GSRS—a clinical rating scale for gastrointestinal symptoms in patients with irritable bowel syndrome and peptic ulcer disease. *Dig Dis Sci* 1988;33:129-134.
4. Tokuda Y, Okubo T, Ohde S, et al. Assessing items on the SF-8 Japanese version for health-related quality of life: a psychometric analysis based on the nominal categories model of item response theory. *Value Health* 2009;12:568-573.
5. Agachan F, Chen T, Pfeifer J, Reissman P, Wexner SD. A constipation scoring system to simplify evaluation and management of constipated patients. *Dis Colon Rectum* 1996;39:681-685.
6. Kusano M, Shimoyama Y, Sugimoto S, et al. Development and evaluation of FSSG: frequency scale for the symptoms of GERD. *J Gastroenterol* 2004;39:888-891.

Supplementary Table 1. Participants' Characteristics

Characteristics	Total (N = 10 000)
Sex	
Male	5023 (50.2)
Female	4977 (49.8)
Age (yr)	46.0 ± 13.4
≥ 20 and < 30	1566
≥ 30 and < 40	1879
≥ 40 and < 50	2365
≥ 50 and < 60	1971
≥ 60 and < 70	2219
Height (cm) ^a	164.6 ± 8.5
Weight (kg) ^a	60.9 ± 12.5
Body mass index (kg/m ²)	22.3 ± 3.5
Place of residence	
Hokkaido	473 (4.7)
Tohoku	623 (6.2)
Kanto	3537 (35.4)
Chubu	1698 (17.0)
Kinki	2120 (21.2)
Chugoku	541 (5.4)
Shikoku	287 (2.9)
Kyushu	721 (7.2)
Occupation	
Company employee	5206
Self-employed/freelancer	795
Part-time worker	1533
Full-time homemaker	1382
Retirement or unemployed	788
Student	178
Other	118
Annual household income (¥)	
< 6 million	4630
≥ 6 million	3483
Prefer not to answer	1000
Do not know	887
Highest educational attainment	
Junior high school	187
High school diploma	2743
Special training school	706
Technical college	508
Junior college	1092
University (4-year system)	4153
Post-graduate qualification	540
Other	71

Supplementary Table 1. Continued

Characteristics	Total (N = 10 000)
Complications	
Hypertension	1187
Diabetes mellitus	435
Hyperlipidemia	702
Gastroduodenal ulcers	597
Hemorrhoidal disease	455
Diverticulosis	68
Other cancers	81
Cerebrovascular and neurological diseases	106
Chronic obstructive pulmonary disease	11
Liver disease	150
Kidney disease	146
Other	245
None	7182

^aIncludes 0.3% overall outlier removal to exclude obvious data entry errors. Values are presented as n (%), mean ± SD, or n.

Supplementary Table 2. Results of the Gastroesophageal Reflux Disease Questionnaire (Participants With Narrow-sense Gastroesophageal Reflux Disease, N = 1223)

Symptoms in the previous week	Symptom presence (day)	Score	n (%)
1. How often did you have a burning feeling behind your breastbone (heartburn)?	0	0	299 (24.4)
	1	1	449 (36.7)
	2-3	2	338 (27.6)
	4-7	3	137 (11.2)
2. How often did you have stomach contents (liquid or food) moving upwards to your throat or mouth (regurgitation)?	0	0	212 (17.3)
	1	1	468 (38.3)
	2-3	2	401 (32.8)
	4-7	3	142 (11.6)
3. How often did you have a pain in the centre of the upper stomach area?	0	3	861 (70.4)
	1	2	179 (14.6)
	2-3	1	123 (10.1)
	4-7	0	60 (4.9)
4. How often did you have nausea?	0	3	807 (66.0)
	1	2	250 (20.4)
	2-3	1	107 (8.7)
	4-7	0	59 (4.8)
5. How often did you have trouble getting a good night's sleep because of Heartburn or regurgitation?	0	0	604 (49.4)
	1	1	372 (30.4)
	2-3	2	169 (13.8)
	4-7	3	78 (6.4)
6. How often did you have a need for over-the-counter medicine for heartburn or regurgitation?	0	0	693 (56.7)
	1	1	241 (19.7)
	2-3	2	153 (12.5)
	4-7	3	136 (11.1)

Supplementary Table 3. Participants Meeting the Criteria for Chronic Constipation According to Japanese Guidelines Were Not Always Aware of Having Constipation

Category	Awareness of constipation		
	Yes	No	Total
Chronic constipation according to Japanese guidelines			
With constipation	1948	1856	3804
Without constipation	615	5581	6196
Total	2563	7437	10 000

Values are presented as n.

Supplementary Table 4. Participants' Socioeconomic Characteristics According to the Presence of Chronic Constipation and Narrow-sense Gastroesophageal Reflux Disease

Characteristic	Chronic constipation guidelines/narrow-sense GERD				Total (N = 10 000)
	Group A: constipation and GERD (n = 693)	Group B: constipation only (n = 3111)	Group C: GERD only (n = 530)	Group D: no constipation, no GERD (n = 5666)	
Place of residence					
Hokkaido	40 (5.8)	143 (4.6)	21 (4.0)	269 (4.7)	473
Tohoku	49 (7.1)	192 (6.2)	35 (6.6)	347 (6.1)	623
Kanto	224 (32.3)	1095 (35.2)	187 (35.3)	2031 (35.8)	3537
Chubu	120 (17.3)	516 (16.6)	97 (18.3)	965 (17.0)	1698
Kinki	148 (21.4)	665 (21.4)	105 (19.8)	1202 (21.2)	2120
Chugoku	33 (4.8)	169 (5.4)	24 (4.5)	315 (5.6)	541
Shikoku	22 (3.2)	94 (3.0)	10 (1.9)	161 (2.8)	287
Kyushu	57 (8.2)	237 (7.6)	51 (9.6)	376 (6.6)	721
Occupation					
Company employee	381 (55.0)	1556 (50.0)	292 (55.1)	2977 (52.5)	5206
Self-employed/freelancer	47 (6.8)	228 (7.3)	53 (10.0)	467 (8.2)	795
Part-time worker	112 (16.2)	501 (16.1)	59 (11.1)	861 (15.2)	1533
Full-time homemaker	84 (12.1)	506 (16.3)	67 (12.6)	725 (12.8)	1382
Retirement or unemployed	56 (8.1)	228 (7.3)	49 (9.2)	455 (8.0)	788
Student	8 (1.2)	58 (1.9)	3 (0.6)	109 (1.9)	178
Other	5 (0.7)	34 (1.1)	7 (1.3)	72 (1.3)	118
Annual household income (¥)					
< 6 million	336 (48.5)	1564 (50.3)	259 (48.9)	2471 (43.6)	4630
≥ 6 million	252 (36.4)	1007 (32.4)	195 (36.8)	2029 (35.8)	3483
Prefer not to answer	54 (7.8)	269 (8.6)	39 (7.4)	638 (11.3)	1000
Do not know	51 (7.4)	271 (8.7)	37 (7.0)	528 (9.3)	887
Highest educational attainment					
Junior high school	15 (2.2)	67 (2.2)	12 (2.3)	93 (1.6)	187
High school diploma	190 (27.4)	853 (27.4)	147 (27.7)	1553 (27.4)	2743
Special training school	55 (7.9)	223 (7.2)	34 (6.4)	394 (7.0)	706
Technical college	45 (6.5)	153 (4.9)	32 (6.0)	278 (4.9)	508
Junior college	67 (9.7)	411 (13.2)	48 (9.1)	566 (10.0)	1092
University (4-year system)	286 (41.3)	1238 (39.8)	232 (43.8)	2397 (42.3)	4153
Post-graduate qualification	30 (4.3)	133 (4.3)	23 (4.3)	354 (6.2)	540
Other	5 (0.7)	33 (1.1)	2 (0.4)	31 (0.5)	71

GERD, gastroesophageal reflux disease.
Values are presented as n (%).

Supplementary Table 5. Eight-item Short Form Health Survey Questionnaire and Gastrointestinal Symptom Rating Scale Scores According to the Presence of Chronic Constipation and the Presence of Narrow-sense Gastroesophageal Reflux Disease

Score	Chronic constipation guidelines/narrow-sense GERD				Total (N = 10 000)
	Group A: constipation and GERD (n = 693)	Group B: constipation only (n = 3111)	Group C: GERD only (n = 530)	Group D: no constipation, no GERD (n = 5666)	
SF-8 score					
Physical functioning	48.4 ± 6.6	50.7 ± 5.8	49.7 ± 6.3	51.8 ± 5.2	51.1 ± 5.7
Role physical	47.7 ± 7.5	50.8 ± 6.1	50.1 ± 6.3	52.1 ± 5.7	51.2 ± 6.2
Bodily pain	46.0 ± 8.8	49.8 ± 8.6	48.0 ± 8.4	52.6 ± 7.8	51.1 ± 8.4
General health	46.4 ± 7.4	50.5 ± 6.6	49.0 ± 7.0	53.0 ± 6.4	51.5 ± 6.9
Vitality	47.5 ± 6.7	50.1 ± 6.2	49.2 ± 6.4	52.3 ± 5.7	51.1 ± 6.2
Social functioning	46.6 ± 7.9	50.1 ± 6.9	49.2 ± 7.2	52.0 ± 5.9	50.9 ± 6.6
Role emotional	46.1 ± 7.7	49.0 ± 7.1	48.3 ± 7.3	51.3 ± 6.1	50.1 ± 6.8
Mental health	45.0 ± 8.0	48.2 ± 7.5	48.1 ± 7.8	51.3 ± 6.7	49.7 ± 7.4
Physical component summary	47.0 ± 7.1	50.1 ± 6.3	48.6 ± 6.6	51.5 ± 5.8	50.6 ± 6.2
Mental component summary	44.9 ± 7.7	47.7 ± 7.5	47.5 ± 7.6	50.4 ± 6.4	49.0 ± 7.1
GSRS score					
Total	2.8 ± 1.1	1.9 ± 0.8	2.1 ± 1.0	1.3 ± 0.5	1.7 ± 0.8
Acid Regurgitation	2.8 ± 1.3	1.5 ± 0.8	2.4 ± 1.2	1.2 ± 0.5	1.5 ± 0.9
Abdominal pain	2.5 ± 1.3	1.6 ± 0.9	2.0 ± 1.1	1.3 ± 0.6	1.5 ± 0.9
Dyspepsia	2.8 ± 1.2	1.9 ± 1.0	2.1 ± 1.1	1.4 ± 0.6	1.7 ± 0.9
Diarrhea	2.7 ± 1.4	1.9 ± 1.2	2.2 ± 1.4	1.5 ± 0.9	1.7 ± 1.1
Constipation	3.2 ± 1.4	2.5 ± 1.3	1.8 ± 1.0	1.4 ± 0.7	1.9 ± 1.2

GERD, gastroesophageal reflux disease; SF-8, 8-item Short Form Health Survey Questionnaire; GSRS, Gastrointestinal Symptom Rating Scale. Values are presented as mean ± SD.

Supplementary Table 6. Concomitant Use of Gastric and Constipation Drugs

Type of constipation medication	Type of gastric medication								Total
	PPI	PCAB	Histamine H2 receptor blocker	Prokinetic agent	Herbal drug	Other	Unknown, oral	No oral administration	
Stimulant laxatives	85 (60.7)	18 (31.0)	56 (49.1)	9 (18.8)	20 (29.0)	14 (27.5)	12 (24.5)	233 (39.2)	447
Enemas and suppositories	11 (7.9)	18 (31.0)	14 (12.3)	7 (14.6)	10 (14.5)	4 (7.8)	4 (8.2)	52 (8.8)	120
Saline laxatives	23 (16.4)	10 (17.2)	28 (24.6)	15 (31.3)	12 (17.4)	19 (37.3)	11 (22.4)	140 (23.6)	258
Osmotic laxatives	4 (2.9)	1 (1.7)	3 (2.6)	4 (8.3)	4 (5.8)	0 (0)	1 (2.0)	2 (0.3)	19
Inflatable laxatives	0 (0)	1 (1.7)	1 (0.9)	2 (4.2)	6 (8.7)	0 (0)	0 (0)	4 (0.7)	14
Chloride channel activator/ guanylate cyclase C agonists/ ileal bile acid transporter	0 (0)	1 (1.7)	0 (0)	1 (2.1)	5 (7.3)	0 (0)	1 (2.0)	6 (1.0)	14
Polyethylene glycol	2 (1.4)	1 (1.7)	0 (0)	1 (2.1)	3 (4.3)	0 (0)	0 (0)	4 (0.7)	11
Other	10 (7.1)	6 (10.3)	6 (5.3)	3 (6.3)	7 (10.1)	12 (23.5)	3 (6.1)	54 (9.1)	101
Unknown, oral	5 (3.6)	2 (3.4)	6 (5.3)	6 (12.5)	2 (2.9)	2 (3.9)	17 (34.7)	99 (16.7)	139

PPI, proton pump inhibitor; PCAB, potassium ion-competitive acid blocker.
Values are presented as n (%) or n.

Supplementary Table 7. Prescription Rate of Laxatives in Participants Who Had Proton Pump Inhibitors or Potassium Ion-competitive Acid Blockers

Laxative use	With GERD (n = 216)	Without GERD (n = 336)	Total (N = 552)
Yes	71 (32.9)	82 (24.4)	153
No	145 (67.1)	254 (75.6)	399

GERD, gastroesophageal reflux disease.
Values are presented as n (%) or n.

Supplementary Table 8. Number of Participants With Chronic Constipation and Gastroesophageal Reflux Disease (With Gastroesophageal Reflux Disease Defined as Frequency Scale for the Symptoms Score ≥ 8)

Constipation status	GERD (defined as FSSG score ≥ 8)			OR [95% CI]
	With GERD	Without GERD	Total	
Chronic constipation according to the guideline				
Yes	1734 (61.6)	2070 (28.8)	3804	3.97 [3.63, 4.35]
No	1079 (38.4)	5117 (71.2)	6196	
Total	2813	7187	10 000	

FSSG, Frequency Scale for the Symptoms of GERD; GERD, gastroesophageal reflux disease.
 Values are presented as n (%) or n.